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10 CFR § 50.73
L-2010-046

MAR 1 1 2010

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D. C. 20555-0001

Re: Turkey Point Unit 4
Docket No. 50-251
Reportable Event: 2010-002-00
Date of Event: January 11, 2010
Reactor Trip Resulting from Steam Generator Feedwater Pump Trip

The attached Licensee Event Report 05000251/2010-002-00 is being submitted pursuant to the requirements of 10 CFR 50.73(a)(2)(iv)(A) to provide notification of the subject event.

If there are any questions, please call Mr. Robert Tomonto at 305-246-7327.

Very truly yours,

Paul W. Rubin
for:

Michael Kiley
Vice President
Turkey Point Nuclear Plant

Attachment

cc: Regional Administrator, USNRC, Region II
Senior Resident Inspector, USNRC, Turkey Point Nuclear Plant

IE22
NRR

NRC FORM 366 (9-2007) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB: NO. 3150-0104 EXPIRES: 08/31/2010

Estimated burden per response to comply with this mandatory collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records and FOIA/Privacy Service Branch (T-5 F52), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to infocollects@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202, (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose an information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

LICENSEE EVENT REPORT (LER)

1. FACILITY NAME	2. DOCKET NUMBER	3. PAGE
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4. TITLE

Reactor Trip Resulting from Steam Generator Feedwater Pump Trip

5. EVENT DATE			6. LER NUMBER			7. REPORT DATE			8. OTHER FACILITIES INVOLVED	
MONTH	DAY	YEAR	YEAR	SEQUENTIAL NUMBER	REV NO.	MONTH	DAY	YEAR	FACILITY NAME	DOCKET NUMBER
1	11	2010	2010	- 002 -	00	3	11	2010	FACILITY NAME	DOCKET NUMBER

9. OPERATING MODE

1

10. POWER LEVEL

30

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR§: *(Check all that apply)*

☐ 20.2201(b)	☐ 20.2203(a)(3)(i)	☐ 50.73(a)(2)(i)(C)	☐ 50.73(a)(2)(vii)
☐ 20.2201(d)	☐ 20.2203(a)(3)(ii)	☐ 50.73(a)(2)(ii)(A)	☐ 50.73(a)(2)(viii)(A)
☐ 20.2203(a)(1)	☐ 20.2203(a)(4)	☐ 50.73(a)(2)(ii)(B)	☐ 50.73(a)(2)(viii)(B)
☐ 20.2203(a)(2)(i)	☐ 50.36(c)(1)(i)(A)	☐ 50.73(a)(2)(iii)	☐ 50.73(a)(2)(ix)(A)
☐ 20.2203(a)(2)(ii)	☐ 50.36(c)(1)(ii)(A)	☒ 50.73(a)(2)(iv)(A)	☐ 50.73(a)(2)(x)
☐ 20.2203(a)(2)(iii)	☐ 50.36(c)(2)	☐ 50.73(a)(2)(v)(A)	☐ 73.71(a)(4)
☐ 20.2203(a)(2)(iv)	☐ 50.46(a)(3)(ii)	☐ 50.73(a)(2)(v)(B)	☐ 73.71(a)(5)
☐ 20.2203(a)(2)(v)	☐ 50.73(a)(2)(i)(A)	☐ 50.73(a)(2)(v)(C)	☐ OTHER
☐ 20.2203(a)(2)(vi)	☐ 50.73(a)(2)(i)(B)	☐ 50.73(a)(2)(v)(D)	Specify in Abstract below or in NRC Form 366A

12. LICENSEE CONTACT FOR THIS LER

NAME	TELEPHONE NUMBER (Include Area Code)
Paul F. Czaya	305-246-7150

13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT

CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX	CAUSE	SYSTEM	COMPONENT	MANU-FACTURER	REPORTABLE TO EPIX

14. SUPPLEMENTAL REPORT EXPECTED

☐ YES *(If yes, complete 15. EXPECTED SUBMISSION DATE)* ☒ NO

15. EXPECTED SUBMISSION DATE

MONTH	DAY	YEAR
-	-	-

ABSTRACT *(Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)*

On January 11, 2010, at approximately 1058 an unplanned manual reactor trip on Unit 4 was initiated due to Steam Generator (SG) level being greater than 75%. The unit was stabilized in Mode 3 on off-site power with main feed for decay heat removal. The unit trip was precipitated by the manual stop of the 4A SG feedwater pump (SGFP) due to a degrading oil inventory. Plant response to the loss of the 4A SGFP and the subsequent reactor trip was as expected. The root cause of the loss of the 4P1A SGFP lube oil level was determined to be unresponsive seal water injection controls to the pump outboard bearings which resulted in inadequate seal water injection flow to the 4P1A SGFP outboard seal coincident with SGFP bearing cavity drain blockage. Corrective actions include: 1) Replace obsolete Unit 3 and 4 SGFP seal water hand controller stations with more responsive controller stations. 2) A preventive maintenance activity will be established to verify the bearing seal cavity drains are clear on a periodic basis, after completion of maintenance and prior to SGFP start following an outage.

NARRATIVE

DESCRIPTION OF THE EVENT

On January 11, 2010, at approximately 1058 an unplanned manual reactor trip on Unit 4 was initiated due to Steam Generator (SG) level being greater than 75%. The unit was stabilized in Mode 3 on off-site power with main feed for decay heat removal. Auxiliary Feed Water (AFW) actuation was not required.

Prior to the reactor trip at approximately 0520, both Unit 4 Heater Drain Pumps (HDP) tripped. Power was stabilized at 93%. The HDPs were restored and system monitoring prior to power ascension was in progress. However, at approximately 1040, it was reported that the 4A Steam Generator Feed Pump (SGFP) was leaking oil and water from the pump outboard end and the oil reservoir level was lowering. At approximately 1050, a fast load reduction was initiated to support removing the 4A SGFP from service, however, degrading oil inventory prompted a field recommendation that the pump be immediately stopped. At approximately 1055, the 4A SGFP was manually stopped from the Control Room with power at 90%, causing an automatic turbine runback.

SG level decreased as expected, but was maintained above the Low-Low level AFW actuation setpoint of 10%. SG level then increased rapidly and a manual reactor trip was initiated when level exceeded 75% on the 4B SG. Reactor power level at the time of the manual trip was approximately 30%.

The reactor trip was reported to the NRC Operations Center in accordance with 10 CFR 50.72(b)(2)(iv)(B). The Event Notification number is 45619. Condition Report 2010-679 was initiated to evaluate the plant trip.

CAUSE OF THE EVENT

The cause of the unit trip was an anticipated outcome of losing a SGFP at the exhibited operating power level. The root cause of the loss of the 4P1A SGFP lube oil level was determined to be unresponsive seal water injection controls to the pump outboard bearings which resulted in inadequate seal water injection flow to the 4P1A SGFP outboard seal coincident with SGFP bearing cavity drain blockage. It is worthy of note that the low oil event was a result of two conditions occurring at the same time and the loss of oil would have not occurred if only one of these conditions were present.

ANALYSIS OF THE EVENT

At approximately 1000 on January 11, 2010, Engineering began to investigate a report by Operations that the oil level in the 4P1A SGFP was low. Upon arriving at the pump, it was noted that the oil level in the main oil reservoir was low. Inspections of the main oil reservoir bulls-eye noted that the glass was clear, which could indicate that the main oil reservoir was full of water, or that the oil level was low and out of sight. Inspections also noted that there was a significant amount of oil leaking out from the outboard bearing housing deflector. Additionally, water and steam were emanating from the outboard stuffing box cover shaft seal/bearing drain trough area in significant amounts.

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NARRATIVE

Because initial inspections indicated that the oil level was extremely low or indeterminate, and there was a possibility that water was accumulating within the main oil reservoir, there was no accurate way to determine if the 4P1A SGFP was receiving adequate lubrication, or was about to lose lubrication. Based on this determination, it was recommended that the 4P1A SGFP be shutdown. As the pump was shut off, it was visually noted to coast down normally. Loss of oil, or significant amounts of water within the main oil reservoir, would result in a loss of lubrication and pump/motor bearing damage or failure.

The SGFPs of both units 3 and 4 are Byron Jackson 12 x 14 x 17 – 2 stage DVMX pumps which utilize a central oil system consisting of a main oil reservoir and shaft driven gear pump, which supplies lubricating oil to all the pump and motor bearings. In this design, the gear pump feeds a main header pipe which has four individual branch pipes that feed the pump outboard and inboard bearings then the motor inboard and outboard bearings. Oil flow to the individual bearings is regulated by supply side bearing orifices and a pressure regulating relief valve. After the injected oil passes through the motor and pump bearings; the oil is captured within the associated bearing housing. The oil then drains back to the main oil tank and is utilized as a supply for the shaft driven oil pump.

The Turkey Point SGFPs employ a controlled leakoff design to seal the inboard and outboard pump shafts which protrude through the pump casing. This controlled leakoff design is fed by a seal water injection system which injects condensate pump discharge into a mixing chamber within the stuffing box. The injected liquid mixes with process fluid flowing along the pump shaft pressure breakdown bushing and cools it. The mixture then flows out of the bushing and into the seal water collection tank piping.

Seal injection is modulated by a seal injection valve and by throttling the stuffing box leakoff back pressure. The seal injection valve is controlled by a hand-auto controller that uses stuffing box leakoff temperature to modulate the seal injection valve so that the stuffing box temperature is at a setpoint level. For the 4P1A SGFP, seal injection for the inboard stuffing box is fed by control valve CV-4-2207 and the outboard stuffing box is fed by CV-4-2206.

As a result of this event, the 4P1A SGFP was disassembled and inspected to determine the cause of the low oil level. Initial oil sampling found the oil to be contaminated with water and emulsified. There was no free water at the bottom of the main oil tank or anywhere else in the system. The oil level in the main oil tank was low but not below the main oil pump suction strainer. No abnormal physical conditions were found within the 4P1A SGFP (i.e. excessive internal clearances, degraded parts, etc.) which would have caused the oil leakage from the outboard bearing labyrinth seal and resulted in the low oil condition.

The outboard bearing seal cavity drain was clogged. Insulation was found plugging the drain entrance. The source of the insulation was from the insulating blanket on the pump casing. This insulation blanket was replaced with new blankets. The outboard seal cavity drain and cavities were cleaned.

A blocked outboard seal cavity drain will result in water contamination into the bearing housing when the cavity drain fills up and floods the deflector. The discovered water contamination was due to this condition since the drain was found to be blocked.

LICENSEE EVENT REPORT (LER)
TEXT CONTINUATION

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NARRATIVE

The outboard seal injection system was found to be responding abnormally and resulted in leakage of water/steam from the 4P1A SGFP outboard stuffing box shaft seal. Since the outboard shaft seal cavity was discovered to be clogged, while water was emanating from the outboard stuffing box shaft seal, this resulted in flooding the outboard bearing housing labyrinth seal, which resulted in the labyrinth seal becoming hydraulically locked. This created a siphoning or pumping effect that pulled oil from the bearing housing drain cavity and drained the main oil reservoir. The two conditions in themselves could not have caused the low oil condition, however when they occurred simultaneously, the result was in the low oil level. The cause for the sluggish CV-4-2206 valve was a degraded hand-auto controller.

Plant response to the loss of the 4A SGFP was as designed. Operations personnel performed in accordance with plant operating procedures, training and management expectations.

Reportability

10 CFR 50.73(a)(2)(iv)(A) requires a written report of valid actuations of the reactor protection system. Since a manual reactor trip was initiated in response to increasing steam generator water level, this event is being reported herein.

ANALYSIS OF SAFETY SIGNIFICANCE

Since plant response to the 4A SGFP trip and subsequent reactor trip was as expected, no safety systems actuated other than the anticipatory manual reactor trip, and the plant was safely brought to a shutdown condition, the safety significance of this event is minimal.

CORRECTIVE ACTIONS

Corrective actions include:

1. Replace obsolete Unit 3 and 4 SGFP seal water hand controller stations with more responsive controller stations.
2. A preventive maintenance activity will be established to verify the bearing seal cavity drains are clear on a periodic basis, after completion of maintenance and prior to SGFP start following an outage.

ADDITIONAL INFORMATION

EIIS Codes are shown in the format [EIIS SYSTEM: IEEE system identifier, component function identifier, second component function identifier (if appropriate)].

FAILED COMPONENTS IDENTIFIED: None

PREVIOUS SIMILAR EVENTS: None